

2017

Survey of Pesticide Use in British Columbia

Integrated Pest Management Program



Executive Summary

It is important for any regulatory agency to have current data on key aspects of the industries it regulates in order to operate in an effective, risk-based fashion and to be transparent with that information so the general public can access and make use of the data. The Ministry of Environment and Climate Change Strategy's (ENV) Integrated Pest Management (IPM) Program regulates the sale and use of pesticides in British Columbia through the *Integrated Pest Management Act* (IPMA) and subsequent Integrated Pest Management Regulation (IPMR) and strives to reduce risk to human health and the environment from the sale, transport or use of pesticides. To help achieve this goal, we undertook an analysis of data on the use of pesticides in the province in 2017, which can be used as a tool in the guidance of policy development and program management.

The data for this report is compiled from mandatory submissions from proponents who were authorized to use pesticides in B.C. in 2017 for select uses outlined as per the IPMR. The results indicate the type and quantity of active ingredients (AI) used, the number of times the AI was reported used, and the area treated (for select uses).

This summary is intended only to provide an overview of pesticide use in British Columbia in 2017. Additional information – including industry sector review papers, explanatory notes, other guidance documents and links to the Act and Regulation can be accessed at the following Ministry of Environment and Climate Change Strategy web page: www.gov.bc.ca/PestManagement.

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Citation and further information

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Section 1: Introduction

Integrated Pest Management in B.C.

The federal *Pest Control Products Act* (PCPA) was created in 2002 to protect human health and the environment by regulating the sale and use of pest control products in Canada (Pest Control Products Act, 2002). The PCPA is administered by Health Canada's Pest Management Regulatory Agency (PMRA) and is responsible for regulating the approval process for marketable pesticides in Canada. Once a product is approved for the Canadian market, the provincial *Integrated Pest Management Act* (IPMA) and Integrated Pest Management Regulation (IPMR) outline the sale, transport, storage, application, disposal and reporting requirements for pesticides in British Columbia (B.C.).

In B.C. the IPMA outlines the legislation for pest management in B.C. including requiring the use of Integrated Pest Management (IPM) when managing pests to reduce the risk of harm to human health and the environment. IPM is intended to improve the success of pest management efforts while reducing their impact on the environment by minimizing the unnecessary use of pesticides. IPM is defined in the IPMA as, "a process for managing pest populations that includes the following elements:

1. Planning and managing ecosystems to prevent organisms from becoming pests;
2. Identifying pest problems and potential pest problems;
3. Monitoring populations of pests and beneficial organisms, damage caused by pests and environmental conditions;
4. Using injury thresholds in making treatment decisions;
5. Suppressing pest populations to acceptable levels using strategies based on considerations of (i) biological, physical, cultural, mechanical, behavioral and chemical controls in appropriate combinations, and (ii) environmental and human health protection;
6. Evaluating the effectiveness of pest management treatments" (IPMA, 2003, Pt.1).

The IPM approach provides land owners and stewards with a structure for incorporating regular monitoring and collection of information to decide when and if treatment is needed, and what type of treatment action must be taken; it involves using a combination of strategies (biological, manual, chemical etc.) to treat pest problems and continual evaluation of those strategies. There are several advantages to using an IPM approach:

- Provides long term solutions for pest prevention and suppression;
- Reduces the amount of pesticide used by using a combination of treatments, which in turn reduces the risk of harm to human health and the environment; and
- Provides options for pest managers to control pesticide resistant pests.

Pesticide Management

Under the IPMA a pesticide is described as a, “micro-organism or material that is present, sold, used or intended to be used to prevent, destroy, repel or mitigate a pest” (IPMA, 2003, Pt.1). The IPMA and IPMR outline conditions for sale and use of pesticides through a pesticide classification system, regulatory standards, and provisions for authorizations. There are several types of authorizations for pesticide use in B.C. including: certifications, licenses, permits and confirmations; proponents receive a confirmation authorization after preparing a Pest Management Plan (PMP) and consulting with the public.

There are five classes of pesticides in B.C. based on their risk to human health and the environment:

Permit Restricted ¹	Pesticides the IPMR Administrator requires a permit for purchase and application as the risk of unreasonable adverse effects from their use should be evaluated for each proposed use.
Restricted	Pesticides designated under the PCPA as restricted. Under the IPMR, this class of pesticide requires a pesticide applicator certificate for purchase or use.
Commercial	Pesticides designated under the PCPA as commercial. Agricultural and industrial pesticides are also considered commercial under the IPMR.
Domestic	Pesticides designated as domestic under the PCPA exclude permit restricted or excluded pesticides and are contained in a fertilizer registered under the <i>Fertilizer Act</i> (Canada).
Excluded ²	Pesticides that the Administrator has excluded from requirements under the IPMR as their use without a licence, permit or confirmation will not increase the risk of unreasonable adverse effects.

Under the IPMA, a person must not “use a pesticide that causes or is likely to cause, or use, handle, release, transport, store, dispose of, or sell a pesticide in a manner that causes or is likely to cause an unreasonable adverse effect” (IPMA, 2003, Pt.2).

Regulatory Standards for Use

Those who wish to apply non-excluded pesticides to public land, some private land, and bodies of water must acquire an authorization such as a permit, license, or confirmation. There are two types of licenses in B.C.: (1) pesticide use service licence for those applying pesticides for a fee and (2) pesticide use non-service licence for those who conduct work on their own land with their own employees. Some

¹ There are currently only two permit restricted pesticides: 4-aminopyridine and monosodium methanearsonate (MSMA).

² A list of excluded pesticides can be viewed under Schedule 2 of the Integrated Pest Management Regulation

proponents may require multiple authorizations in order to use pesticides depending on their operations and some proponents may only work under a single license or a confirmation. For more information on the specifications for each authorization type please see the parameters laid out in the [Integrated Pest Management Act and Regulations Summary](#).

Reporting Requirements

Proponents applying pesticides in B.C. keep daily use records. This information includes (a) the name and certificate number of the pesticide applicator certificate holder who used the pesticide or supervised the use; (b) the date and time of the pesticide use; (c) the name of the pest targeted by the use or the purpose of the pesticide use; (d) for each pesticide used, the method and rate of application; and (e) if the use was outdoors, the prevailing meteorological conditions including temperature, precipitation and velocity and direction of the wind. These records are compiled at the end of a year to generate an Annual Use Summary (AUS) which is submitted to the Ministry of Environment and Climate Change Strategy (ENV) by January 31st the following year. The information included in the AUS is:

- The name and address of the authorization holder;
- The following information for each pesticide used in the calendar year:
 - a. Trade name;
 - b. Registration number under the federal Act;
 - c. Active ingredient(s) (AI);
 - d. Amount applied in kilograms; and
 - e. The total area treated with that pesticide (IPMR, 2004, S.39).

If a licensee is applying a pesticide as a service for another licensee, permit holder or confirmation holder or for a person who does not hold a license, permit or confirmation they are required to submit separate reports for each pesticide used, which includes all the information listed above. In addition to all the information listed above, some authorization holders³ have additional requirements for their AUS:

- A description of the treatment location and a map identifying its gross boundaries;
- The methods used to apply pesticide;
- The total area treated with pesticides;
- The total area treated by each pesticide used; and
- Methods of non-pesticide pest controls used and the estimated total area of their use (IPMR, 2004, S.39 (4)).

The daily use records that authorization holders are required to keep are not submitted to ENV staff but must be kept for a period of three years, allowing ENV staff to audit the information provided in the AUS if necessary, to be included in an inspection or requested in response to a complaint. Recording daily use

³ For more information on the specifications for each authorization type please see the parameters laid out in the Integrated Pest Management Act and Regulations Summary available online.

records and providing an AUS is mandatory for all authorization holders. Failure to maintain compliance can result in fines, administrative penalties and prosecution in severe circumstances.

Background

Each year, ENV's Integrated Pest Management Program collects pesticide sales and use data from authorized users in B.C. In 1991, the Ministry of Environment, Lands and Parks (now the Ministry of Environment and Climate Change Strategy) released the first publication of pesticide sales and use data for B.C. Since then, there have been four AUS reports published on pesticide use in B.C.: in 1991 (Norecol Environmental Consultants, 1993), in 1995 (Norecol, Dames and Morre, 1997), in 1999 (ENKON Environmental Limited, 2001), and in 2003 (ENKON Environmental Limited, 2005). This report will not compare data with previous reports or analyze trends because the scope of previous reports varied; the previous AUS reports were based on information required by regulations under previous legislation, which contained different reporting requirements. In addition, the reports either analyzed only a few sectors using pesticides or only reported on a certain area of B.C. (for example the 2003 Survey of Pesticide Use in B.C. only reports on pesticide use for The Georgia Basin Ecosystem).

ENV staff use AUS submissions to assess the quantity and types of pesticide being used, pesticide use by individual companies, and pesticide use by sectors of the province. This information is used to outline when and where to conduct inspections to verify compliance with regulations and may be used to identify trends in pesticide use in the future. In addition, a sound understanding of pesticide sales and use in the province informs how ENV allocates resources and is an important tool for the prioritization of activities and the development of an effective, risk-based regulatory system.

Scope of this Report

This report will address pesticide use by natural resource, industry, and residential service sectors that reported pesticide use in B.C. in 2017 as required under the IPMR, but will not represent all pesticide use in B.C. In B.C., farmers are not required to obtain an authorization for pesticide use on private agricultural land. Hence, farmers do not need to maintain daily use records or submit an AUS form. Therefore, there is no pesticide use data for the agricultural sector provided in this report. In addition, this report does not include private residential pesticide use, pesticide applications done using items listed in Schedule 2 of the IPMR, and applications to treat invasive species on private land.

Data for this report is presented in several categories representative of natural resource and industry sectors; for certain industries (e.g. landscape) data are from proponents who do work for both commercial and residential clients. For each category the active ingredients (AIs) that were reported for use are listed, as well as the amount of each AIs applied. The following sectors also must report the area treated: Forestry, Industrial Vegetation, Noxious Weeds and Invasive Plants, and Mosquito Suppression and Control. The remaining sectors are not required to report area treated in their AUS reports. Authorization holders are not required to submit spatial data specific to pesticide treatment locations; therefore, the totals are compiled for the entire province.

Understanding the IPMR reporting requirements and their implications is complex. Therefore, when reviewing the use data results, review Section 3: Understanding the Data carefully to understand the limitations of the data. ENV IPM staff members are continually striving to improve reporting requirements and processes in B.C.

Purpose and Objectives

The purpose of this report is to provide the public with a summary report of pesticide use in B.C. using AUS's submitted by authorization holders for 2017. Key objectives of this survey report were to:

- Summarize and report on pesticide use quantities in B.C. for 2017;
- Develop a template to continuously evaluate pesticide use in B.C.;
- Highlight the Integrated Pest Management being done in B.C. in 2017; and
- Identify any administrative errors and inconsistencies found in the data collected, with a view to providing constructive feedback to authorization holders and improving the data that is collected each year.

Section 2: Survey Methods

This report provides a quantitative analysis of the amount of pesticide use in B.C. in 2017. The AUS submitted by authorization holders to ENV is mandatory each year. The data from AUS submissions was entered into the IPM database and information tracking system after verifying that the AUS contained complete and accurate information. Authorization holders that submitted an AUS with incomplete or inaccurate information were contacted to obtain the correct information. Analysis of the data included organizing the data into categories of use, sorting data to find missing or NIL values, evaluating and comparing the data and developing tables, figures and graphs.

The IPM database contains information from the PMRA on all registered pesticides in Canada. For each pesticide entered, the database automatically converts the quantity of product reported to provide specific information on the quantity of AI based on federal label guarantees. Thus, this report outlines the amount of AI used and not the amount of the product used. Once data are entered into the IPM database and information tracking system, they can be exported into excel format for analysis.

In 2017, there were 903 authorization holders. ENV received 100% of AUS's from confirmation holders, 98% of AUS's from license holders and 100% of AUS's from permit holders. Some AUS reports received stated that no pesticides were used in the previous year. This may be due to a lack of pest pressure or overlapping authorizations being held as they expire. Data acquired for this report includes AUS data from 129 confirmation holders, 576 license holders and 11 permit holders. Some of the data provided by these authorization holders was also refined throughout the data analysis stage; for example, items that were reported that were not required to be reported (e.g., Excluded pesticides) were removed from the dataset. Therefore, there were 903 authorization holders in 2017 but this report only includes data from AUS's submitted by 716 authorization holders.

Data Analysis and Presentation

To analyze the data, NIL (zero) values were removed, active AIs with multiple guarantees were grouped, and products with more than one type (e.g. insecticide and acaricide) were categorized as a single type based on the primary use of the product as listed on the label. Some AI's come in different products that have different guarantees and were grouped together despite having different guarantee statements. For example, glyphosate was reported in the form of dimethylamine salt, potassium salt, isopropylamine salt or ethanolamine salt, but for this report, they are reported as glyphosate.

For authorization holders who hold licenses for multiple categories (i.e., Landscape and Structural) AI data were sorted into the appropriate category/sector by examining the pesticide label to determine the intention of use.

Grouping Pesticide Use

The results include assessment of the amount of pesticide use by sector or category, types of integrated pest management treatment methods used by certain sectors (aerial, ground and non-chemical), and pesticides used by product type. Data was organized into categories based on natural resource sectors and land management programs that target the same pest. Authorization holders can have one or multiple authorizations depending on their intention for applying pesticide. Categories that outline the results include:

1. Forest Management,
2. Industrial Vegetation, Noxious Weeds and Invasive Plant Management,
3. Invasive Fish Management,
4. Mosquito Suppression and Control,
5. Wood Pole Preservation,
6. Structural Sector,
7. Fumigation Sector,
8. Landscape Sector, and
9. Aquaculture Sector.

Grouping Pesticides by Type

Pesticides are commonly grouped by type based on the pest targeted or on their intended use. For the purposes of this report, pesticides are grouped into the following types:

Table 1: *Types of pesticides and their target pest*

Pesticide	Target Pest
Herbicides	Vegetation
Insecticides	Insects
Acaricides (includes hydrogen peroxide for sea lice control)	Members of the arachnid subclass Acari, which includes ticks and mites
Fungicides	Parasitic fungi or their spores.
Rodenticides	Rodents

Fumigants	Termites, bedbugs and pests in stored grain, processed foods, feeds and non-food commodities.
Wood preservatives	Insects and fungus
Plant Growth Regulators	Vegetation
Animal repellents	Animals with pest properties
Crop Bactericides	Bacteria affecting crop growth
Algaecides	Algae
Piscicide	Fish

Data Control

Human errors made by authorization holders are checked when the data is entered into the IPM database. Some errors that were noticed were (1) authorization holders reporting the amount of pesticides used in the wrong format, (2) the pesticide name not matching the Pest Control Product (PCP) number, (3) pesticides listed on Schedule 2 of the IPMR or Schedule 5 (for select uses) of the IPMR, and (4) listing PCP numbers that are no longer approved by the PMRA. These errors were further addressed by looking up the PCP of the product, reaching out to the authorization holder or removing the error (for items reported that did not need to be).

Data Quality

There are several factors that affect the data quality of this report. First, the information is received using a regulated submission form, which can be sent with errors. These errors may include: rounding errors, addition errors, reading and writing the wrong PCP number, or writing illegibly. Second, the information that ENV receives is limited to what is required by the Integrated Pest Management Regulation (IPMR).

Daily operational records may include estimations or rounding errors. Compilation of information on AUS may be done by a manager and not the applicators which can result in errors when reading and recording the data. Some proponents may also make use of inventory differences to generate information for the AUS.

Data quality is determined partly by the information collected by the AUS form itself. Information for this AUS report came from mandatory annual submissions provided by authorization holders. While the IPMR outlines that each license must report area treated, it is outlined on the official AUS form that certain sectors do not need to report area treated.

The way that the data is input into the IPM database and the way the database outputs the data affects the data quality. In the IPM database, some proponents can be authorized under multiple categories and sectors. Service companies who do work for the forestry sector can aggregate data and not report per customer. As they do not separate out client information, large-scale confirmation holders can report the same information as service companies who worked under their confirmation. Therefore, as private forest land owners do not produce separate reports and our current reporting system does not

tease out this information for private forest lands, this report only speaks to pesticide applied to public forest lands.

Section 3: Understanding the Data

ENV is confident with the data and this report. However, due to how the data is submitted, recorded and processed, there are limitations to consider. To assist in understand the data review the Terminology and Guidance for Interpretation of the Data.

Terminology

Active Ingredient (AI)	An Active Ingredient (AI) is a component of a pesticide product that controls target pests. There can be more than one AI in a product.
Amount of AI	The amount of AI (in kilograms) in a single application is calculated by converting the product amount to kilograms, then multiplying the amount of product by the percent of the AI guarantee of the product.
Adjuvant	An adjuvant is a substance added to the spray tank to improve the performance of the pesticide. The PMRA registers some, but not all adjuvants as pesticides. Therefore, adjuvants reported may not be fully representative of their use in B.C. In addition, surfactants (a type of adjuvant) are listed in Schedule 2 of the IPMR and are not reported.
Area Treated	The area treated with an AI is expressed in hectares (ha). See Guidance for Interpretation of the Data for assistance in understanding the limitations to area treated.
Non-chemical Area Treated	Area treated for non-chemical treatment methods is only required to be reported by confirmation holders and licensees working on private forest land over 20 ha a year. Therefore, it is only reported in the Forestry Management, Industrial Vegetation, Noxious Weeds, and Invasive Plant Management, and the Mosquito Suppression and Control sections of this report.

Guidance for Interpretation of the Data

Active Ingredient (AI)	For all pesticide products there is a wide variation in concentration and application rate depending on application techniques used (brush, stem injection, broadcast etc.) and the bioactivity of each AI (some require higher amounts to manage pest populations than others).
Product vs. Active Ingredient	An Active Ingredient (AI) is a component of a pesticide product that controls target pests. There can be more than one AI in a product.

Area Treated	<p>1. Area reported by authorization holders may be under or over exaggerated and has not been verified by an ENV IPM Officer.</p> <p>2. As some pesticide products contain multiple AIs, the area reported for an AI may have been the same area reported for another AI from the same pesticide product. Therefore, the area treated for the AIs cannot be added together and, if one did, it does not reflect the total area of the province treated with pesticides as the same piece of land may be treated with multiple AIs.</p> <p>3. Some pesticides require only one application while others may have several applications over the same area in a year (e.g., pre-season, mid-season, or post-season).</p> <p>4. Area treated is not required to be reported for structural, fumigation or landscape sections of this report.</p>
Toxicity of Active Ingredient	Pesticides have different levels of toxicity and vary greatly in the amount of product needed to be applied to manage pest populations. Therefore, just because a large amount of a pesticide was used does not imply that it presents, or presented, a greater risk. Some pesticides products only require extremely small amounts to achieve the same level of control as other pesticides that may require larger amounts.
Schedule 2 Pesticides	As outlined in the IPMR, Schedule 2 ⁴ does not need to be reported.
Agricultural Pesticide Use Not Reported	B.C. does not require farmers in the agricultural industry to have an authorization to apply pesticides on all private and most public land nor are they required to report usage. Therefore, agricultural use data is not included in this report.
Commercial Class Pesticides	“Commercial”, “Agricultural”, and “Industrial” pesticides are all considered the same and reported as Commercial under the IPMR.
Under or Over Reporting Area Treated	Due to estimation errors, a proponent may under or over report area treated for chemical and non-chemical applications. Non-chemical data is self-reported for confirmation holders and estimations of size treated could be under or over-exaggerated.

⁴ A list of Schedule 2 items is in Appendix A

Application Methods

When pest control becomes necessary, one or several treatment methods may be used in an IPM program. Cultural, physical, mechanical, biological and chemical (pesticide) controls are all used in IPM programs in B.C. Depending on the pest, the type of application equipment used may vary (Table 2):

Table 2: *Descriptions of pesticide applications*

Method	Further Description
Aerial	Applications using fixed wing and rotary wing planes
Backpack – blower	Applications for granular formulations using a backpack (e.g. mosquito larvicides)
Backpack – broadcast	Applying a spray solution uniformly over the entire treated area using a backpack sprayer and hand nozzle
Backpack – selective	Includes spot, cone and other selective applications using a backpack and hand nozzle
Bandage	Wrapping a pesticide saturated pad around a pole
Basal bark	Combines the herbicide with an oil penetrant and applies the mixture directly to the bark of a standing tree.
Cut and treat	Cutting or wounding a plant and applying pesticide to prevent regrowth
Drill and plug	Drill a hole into a tree or wood pole to fill the hole with a pesticide.
Hand	Applying granular formulations by hand (e.g. mosquito larvicides)
Mechanized foliar – boom	Includes all broadcast applications with a boom (e.g. ATV, truck, Hi rail, etc.)
Mechanized foliar – boomless	Includes all boomless broadcast applications (e.g. ATV, truck, Hi rail, etc.)
Power nozzle or hand gun	Using a hose and hand sprayer to apply pesticides. Nozzles on the boom or handheld gun break the spray into small droplets and direct it to the pest.
Stem injection	Herbicide is injected into a part of each mature stem.
ULV fogger	Ultra Low Volume fogger are hand held sprayers that generate and fog or mist with the pesticide.
Wick or wipe on	Using a pesticide soaked pad to wick, dab or wipe a pesticide onto vegetation.

The distinction between physical and mechanical controls measures is not always clear so these are grouped together. They include examples such as:

Table 3: *Descriptions of non-chemical treatments*

Method	Further Description
Biological control	Includes releases of all biocontrol agents, e.g. weevils, etc.
Browse guards or deer repellent	Devices or products to impede or repel foraging by deer
Brush mats	A revegetation technique that provides a protective vegetative covering
Burning	Includes prescribed burning, etc.
Girdling	Involves cutting away a strip of bark several centimeters wide all the

	way around the trunk to kill a tree pest
Hand pulling	Involves pulling pest vegetation by hand
Manual brushing	Includes all physical cutting of pest vegetation with chain saws, brush saws, etc.
Mechanical removal	Includes excavating or other types of mechanical removal
Mowing	Includes weed whacking, etc.
Livestock grazing	Involves use of animals to forage on pest vegetation (e.g. sheep, goats, etc.)
Stem bending	Breaking off stems to control growth of vegetation

Section 4: Results and Discussion

Pesticide Use in B.C. in 2017

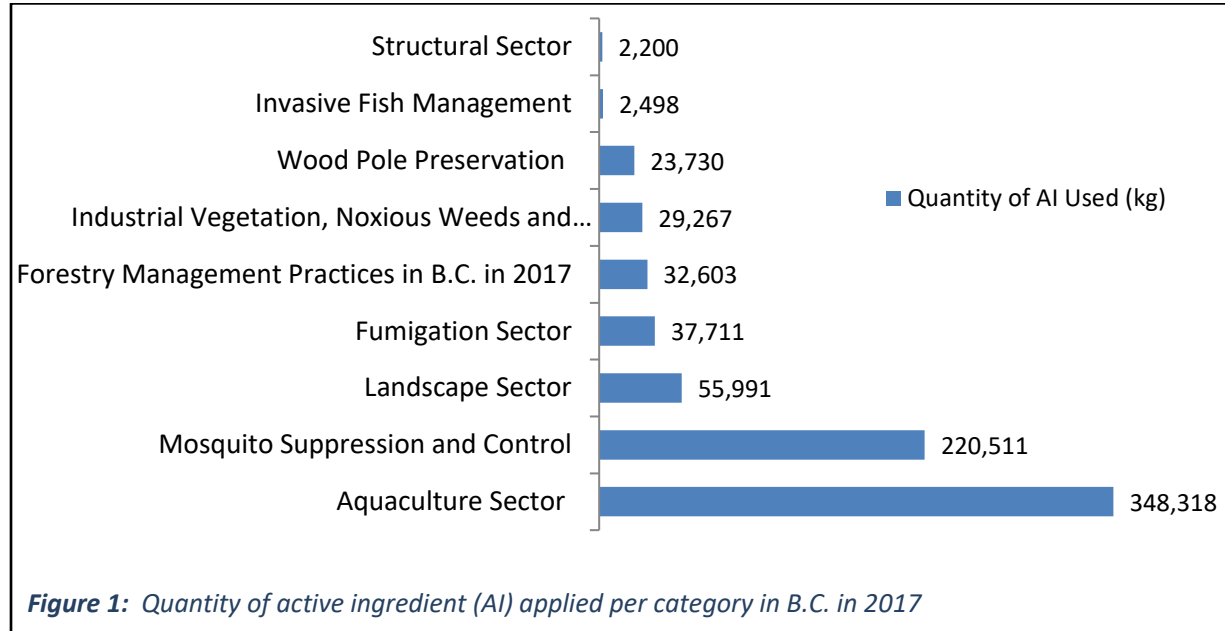
There were 155 AIs that were reported used in 2017 by 716 authorization holders representing 9 categories in B.C. that use pesticides. Of that, 576 (80%) were licensees, 129 (18%) were confirmation holders, and 11 (0.01%) were permit holders (Table 4).

Table 4: Amount of authorization holders that reported AI use in 2017 by use category

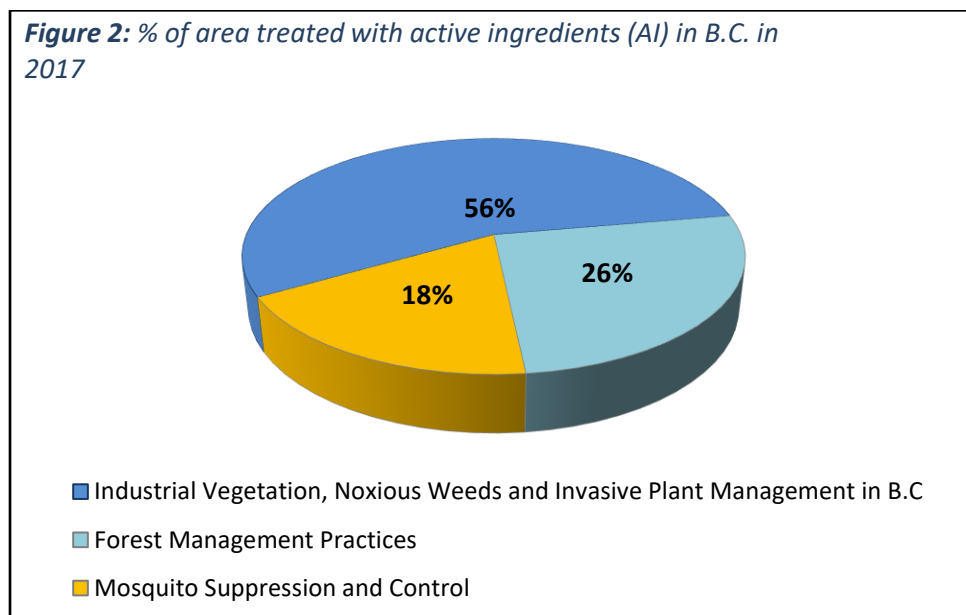
Category of Use	Authorization Holders		
	Licenses	Confirmations	Permits
Forestry Management	-	51	1
Industrial Vegetation, Noxious Weeds and Invasive Species	33	52	1
Invasive Fish Management	-	-	1
Mosquito Suppression and Control	40	24	-
Wood Pole Preservation	29	2	-
Structural Sector	156	-	-
Fumigation Sector	3	-	-
Landscape Sector	315	-	-
Aquaculture Sector	-	-	8
Total	576	129	11

In total, 750,678 kg of AIs were reported used by authorization holders in B.C. in 2017 (Figure 11). The sector in B.C. with the most AI used for pest management was the aquaculture sector with 348,318 kg of hydrogen peroxide used to treat sea lice; hydrogen peroxide presents extremely low risk of any adverse environmental impact but requires enormous amounts of product to achieve efficacy. Mosquito suppression and control used the second highest amount of AIs with 220,511 kg reported. Next, the landscape sector used 55,991 kg of AIs and the fumigation sector used 37,711 kg of AIs; area is not

required to be reported for the landscape and fumigation sectors. The industrial vegetation, noxious weeds and invasive plant category used 31,764.9 kg of AIs. The forestry sector used 30,454.1 kg of AI and 23,764.9 kg of AIs was used for wood pole preservation. The structural sector used the least amount of AIs with 2,195 kg reported used.



As per the IPMR, only three categories reported area treated with chemical and non-chemical treatment methods. In total, 59,877 ha were treated with AI in 2017. Of that, 33,289 ha (56%) was treated for industrial vegetation, noxious weeds and invasive plant management, 15,594 ha (26%) was treated for forest management and 10,993.5 ha (18%) was treated for mosquito suppression and control (Figure 12).



The industrial vegetation, noxious weeds and invasive plant management, forest management, and mosquito suppression and control categories reported using different non-chemical treatment methods. The non-chemical methods used for industrial vegetation, noxious weeds and invasive plant management in B.C represents only 19% of all treatments (chemical and non-chemical) for that category. The non-chemical treatments for forest management were 31% of the total treatments applied. Mosquito suppression and control had the lowest area covered using non-chemical treatments with only 33 ha (0.003%) of all treatments reported for that category.

Pesticides Used for Forest Management in B.C

Review the Following in Section: 3 Understanding the Data



1. Active Ingredient (AI)
2. Area Treated
3. Product vs. Active Ingredient

This section addresses forestry silviculture practices, which protect the establishment of seedlings and forest fiber of mature stands from pests and forest health programs, which protect forests against native and non-native insects, pathogens and invasive plants. Only pesticide applications on public land to manage forest pests are included in this report.

Pesticide Use in Silviculture

The silviculture section of this report is representative of forest practices that focus on vegetation management to protect seedlings from competition and direct damage from pests so forest companies can meet their “free to grow” obligations under the *Forest and Range Practices Act* (FRPA) to regenerate a viable forest stand.

Service companies who work within the forestry sector can aggregate data and not report per customer. As they do not separate out client information, large-scale confirmation holders can report the same information as service companies who worked under their confirmation. Overlap in reporting requirements currently makes separating private land treatments impossible for those treatments conducted by owners and those conducted by service companies. Therefore, this report only speaks to pesticide applied to public forest lands as to not double-report data. Therefore, it is under-representative of the actual pesticide use by the forestry sector in B.C. in 2017. Non-chemical data includes only confirmation holder data.

Glyphosate and triclopyr were the only AIs used for forest silviculture management in B.C. in 2017. The total amount of AIs used was 30,454.1 kg applied to 15,052.8 ha. Glyphosate use was reported 40 times, with a total of 28,050.2 kg of AI used to treat a total of 13,802.8 ha. Triclopyr use was reported 18 times, with a total of 2,403.9 kg of AI used to treat a total of 1,249.9 ha (Figure 3).

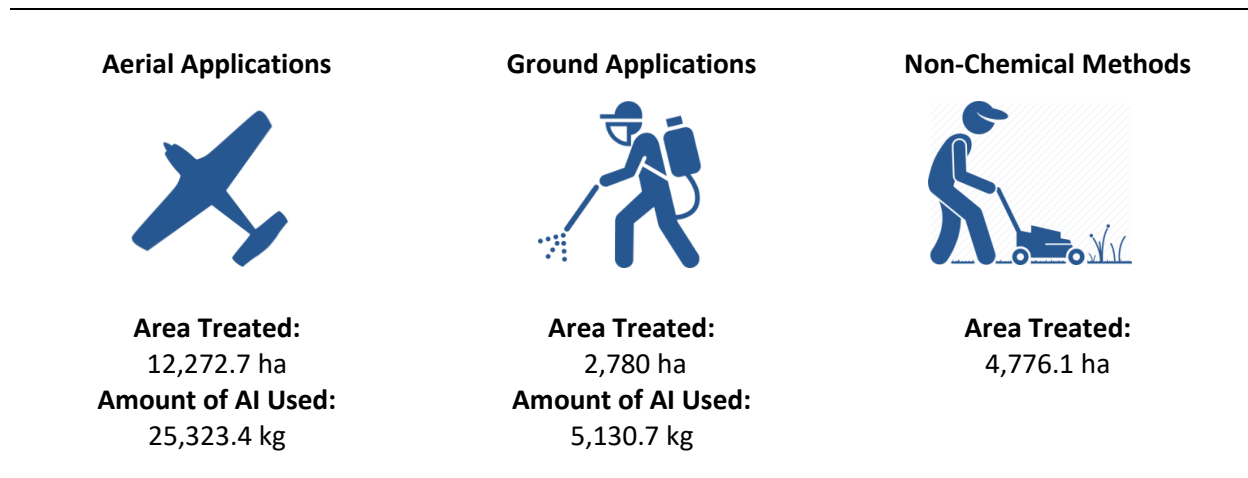
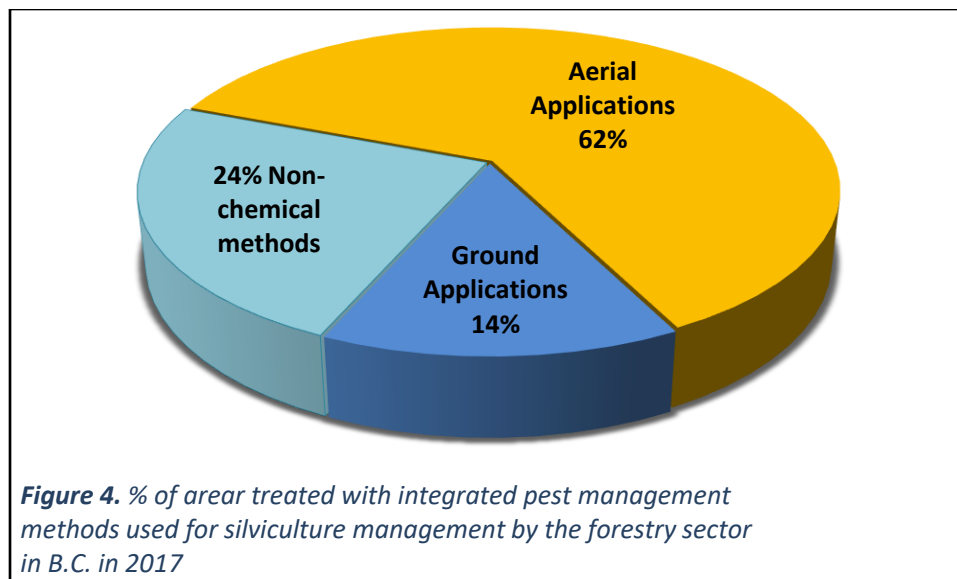


Figure 3: Integrated pest management treatment methods used for silviculture management by the B.C. forestry sector in 2017

Of the 30,454.1 kg of AIs used, 25,323.4 kg was applied through aerial applications, which covered an area of approximately 12,272.7 ha, and 5,130.7 kg was applied through ground applications, which covered an area of 2,780 ha (Figure 3). Confirmation holders also reported treating 4,776.1 ha with non-chemical methods. Of the different treatment methods, aerial applications of pesticide covered the most area treated (62%), followed by non-chemical methods (24%) and ground applications of pesticides (14%) (Figure 4).



Aerial, ground and non-chemical pest management treatment methods were used in the forestry silviculture sector in B.C. in 2017. Types of ground applications for this section include: backpack broadcast, basal bark, cut and treat, stem injection and a combined ground (combination of application types). Types of non-chemical control for this section include: girdling, hand pulling, manual brushing, mechanical removal, sheep grazing and stem bending/knockdown.

Forest Health

The forest health section of this report is representative of forest practices that focus on pest management to protect mature forest stands, enhance ecosystem health and minimize risk to human health from pests and allergens. Major forest health factors in B.C. include insects, diseases, wildlife damage and many abiotic factors such as drought, wildfire, flooding and windthrow. Forest health factors can cause extensive damage and require management to minimize the impacts to B.C.'s forests. Insects, diseases and wildlife damage are actively managed with IPM.

Data for this section is from a single permit acquired for the use of *Bacillus thuringiensis var. kurstaki* (Btk) for control of gypsy moth (*Lymantria dispar dispar*). Btk is a bacterium naturally found in the soil and has been proven to be an effective pest control product for over 30 years in Canada. It is used to target insect larvae, including caterpillars of pest species such as gypsy moth and spruce budworm.

In 2017, there was 2, 149 kg of Btk used, which covered an area of 542 ha. Historically, annual amounts of Btk have been significantly higher. For example, in the 2003 Survey of Pesticide Use in B.C., there was 85,765 kg of Btk applied. Factors that affect forest health treatments include, but are not limited to, cyclical population dynamics of forest pests, environmental conditions affecting susceptibility of trees (e.g., drought and fire), and forest health budget fluctuations.

Total of Pesticide Use for Forest Management in B.C.

Within the forestry sector of B.C., pesticides are used for silviculture management and forest health management. To compare the overall pesticide use at the end of the report, pesticide use in silviculture management and pesticide use for forest health have been combined (Table 5).

Table 5: *Quantity of active ingredient (AI) used and area treated with AI for forestry management in B.C. in 2017*

Forestry Management Practices	Total Amount of AI Used (kg)	Area Treated (ha)
Silviculture Management	30,454.1	15,052.8
Forest Health Management	2,149	542
Total	32,603.1	15,594.8

Glyphosate, triclopyr and Btk were the AIs used for forest management in 2017. In total, 32,603.1 kg of AIs were used for forestry management, which were applied to 15,594.8 ha. AI applied for forest health management accounted for only 6.5% of the total AI used and only 3.5% of the area treated with chemical and non-chemical methods.

Pesticides Used for Industrial Vegetation, Noxious Weeds and Invasive Plant Management in B.C

Review the Following in Section: 3 Understanding the Data



1. Schedule 2 Items
2. Active Ingredient (AI)
3. Adjuvant
4. Area Treated
5. Product vs. Active Ingredient

This section provides information on pesticide use for vegetation management on industrial rights-of-ways (ROWs) and facilities on public and private land, and for invasive/noxious management on public land. Industrial vegetation management is conducted to reduce fire and electrical hazards, maintain sightlines for safety purposes, protect rail bed integrity, and ensure facility access is suitable on public land ROWs such as roadsides, power lines, railway, and pipelines, and other industrial land including well sites, battery sites and oilfield sites. In general, industrial vegetation management is necessary to:

- Allow access for maintenance and emergency repair crews,
- Manage erosion control,
- Reduce the risk of power outages (from tall vegetation growing near power lines), and
- Manage fire hazards.

In addition, roadsides and railways also require vegetation control to:

- Maintain road/railway sign visibility,
- Maintain driver sight distance,
- Manage drain enhancement,
- Reduce road/rail deterioration, and
- For snow drift control.

Invasive plant and noxious weed management in B.C. is done to manage weeds designated as either invasive under FRPA's Invasive Plants Regulation or noxious under the *Weed Control Act* (Canada). Invasive species are plants and animals not native to B.C. or are outside their natural distribution area. They can spread rapidly, outcompete and predate on native species, dominate natural and managed areas, and alter biological communities. Invasive species can negatively impact B.C.'s environment, people and economy. Noxious weeds may present health hazards to either people or livestock. Furthermore, invasive species affect agriculture by competing for available space and nutrients, or by directly attacking native species, crops or landscape plants.

Under the IPMR, management of invasive plants and noxious weeds on public land requires an authorization. On private land, only service licensees providing a service require an authorization to treat invasive plants and noxious weeds. These data include pesticide application data from licensees and confirmation holders and non-chemical data from confirmation holders only. These data includes data from license holders who conduct noxious weed and invasive plant management for regional

districts, municipalities and invasive plant societies. Invasive species and noxious weed management is also conducted on industrial land in addition to industrial vegetation management. Industrial operations may conduct weed management for industrial purposes or environmental protection. Highway maintenance and construction contractors must manage invasive species at the roadside.

In 2017, there were four types of pesticide products applied for industrial vegetation, noxious weeds and invasive plant management: herbicide, fungicide, insecticide and adjuvant (Table 7). Of the pesticide product types, herbicide was the most widely used, with a total use of 29,025.7 kg, followed by fungicide with a total of 177 kg, then insecticide with a total of 3.1 kg and adjuvants with a total of 61 kg. Herbicide was also applied to the greatest area, with 32,834.5 ha being treated by confirmation holders, followed by fungicide (132.1 ha), insecticide (50.5 ha), and adjuvant (272.1 ha). Of the 29,266.9 kg of Als used for industrial vegetation, noxious weeds and invasive plant management, 99.2% was herbicide. The remaining 0.81% contained 0.6% fungicide, 0.2% adjuvant and 0.01% insecticide

Aerial, ground application and non-chemical methods were used by the industrial vegetation, noxious weeds and invasive plant management sector in 2017. Types of ground applications for this section include: backpack-broadcast, backpack-non-broadcast, basal bark, cut and treat, mechanized foliar (boom and boomless), and power nozzle or hand gun. Types of non-chemical control for this section include: excavating, girdling, hand pulling, manual brushing, and mechanical removal and stem bending/knockdown.

Of the 29,266.9 kg of Als used, 128.2 kg was applied through aerial applications, which covered an area of approximately 60 ha, and 29,138.7 kg was applied through ground applications, which covered an area of 33,229 ha. Non-chemical methods covered 6,392.5 ha (Figure 5).

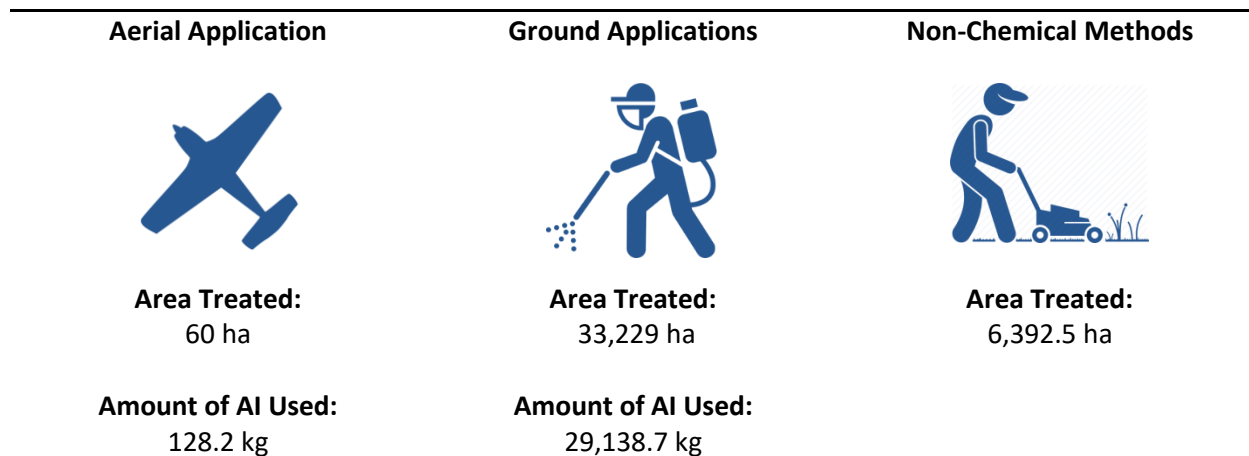
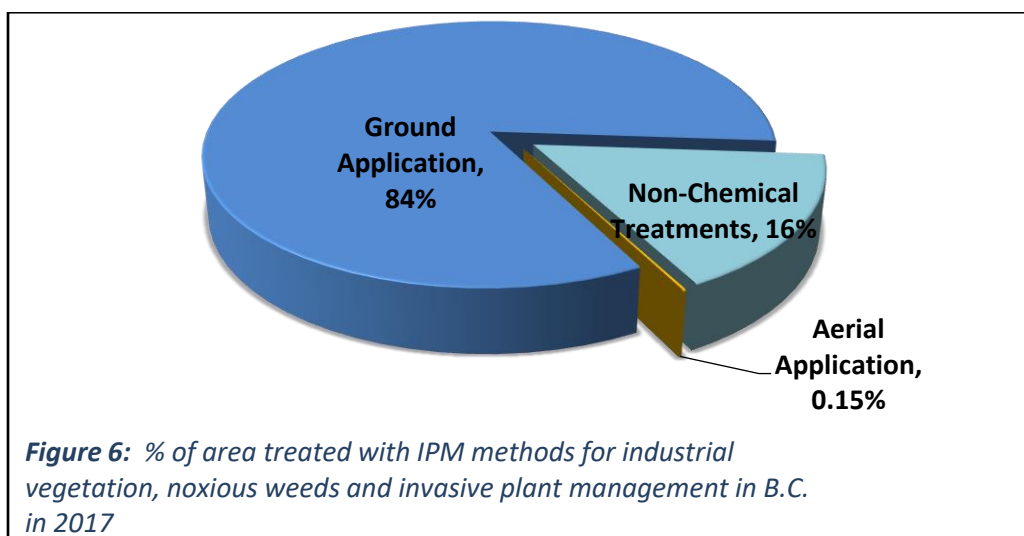


Figure 5: Integrated pest management treatment methods used for industrial vegetation, noxious weeds and invasive plant management in B.C. in 2017

In total, the area treated by ground applications was 84% of the total area treated. Non-chemical applications represent 16% and aerial applications represent 0.15% of the area treated in 2017. Ground applications of pesticides covered the most area treated followed by non-chemical treatments and

aerial application (Figure 6). One reason for the heavy reliance on this approach is a majority of this work is done by ground applications to manage weeds designated as noxious on private and public land on rights-of-ways such as roadsides, power lines and railways where ground access is needed.



For each AI, Table 6 presents the amount of AI used and corresponding area treated. In addition, it outlines how many times the AI was reported by authorization holders. It is important to note that authorization holders may submit data for multiple AIs and products with multiple AIs.

Table 6: Quantity of active ingredient (AI), area treated by each AI and the number of times the AI was reported used for industrial vegetation, noxious weeds and invasive plant management in B.C. in 2017

Pesticide Active Ingredients ⁵	Quantity of Active Ingredient Used (kg)	Total Area Treated (ha)	# of Times AI was Reported Used
Glyphosate	18,138.4	9,501.3	113
MCPA	2,843.1	3,919.3	23
Triclopyr	2,287.1	1,327.7	19
2,4-D	2,241.1	1,944.5	43
Dicamba	977.1	1,729.4	32
Picloram	913.6	1,828.8	46
Aminopyralid	743.4	5,421.1	66
Diuron	346.2	53.4	3
3-Iodo-2-propynyl butyl carbamate	177	132.1	4
Indaziflam	141.7	1,889.3	5
Imazapyr	116.4	148.9	18
Metsulfuron-methyl	115.5	4,391.8	43
Clopyralid	53.6	139.2	19

⁵ Active Ingredients with a (*) indicate that only commercial class pesticides of those items are represented in this report.

Methyl ester	34.2	19.5	2
Methyl and ethyl oleate	26.8	252.6	3
Simazine (plus related active triazines)	21.5	6.3	1
Flumioxazin	17.4	86.7	3
Alcohol ethoxylate	12.1	4.8	1
Diquat	10.9	0.6	1
Acetic acid*	9.6	0.1	2
Chlorsulfuron	7.5	271.7	2
Aminocyclopyrachlor	6.9	37.2	2
Mecoprop-p-dimethylammonium	5.3	2.5	7
Amitrole	4.9	25	1
Dichlobenil	4.5	0.01	1
Bromoxynil	3.7	66.4	5
Piperonyl butoxide*	2.8	25.3	1
Glufosinate ammonium	2.3	1.7	1
Mesosulfuron-methyl	1.1	35.5	1
FeHEDTA	0.609	0.3	2
Pyrethrins (Cinerin I, Cinerin II, Jasmolin I, Jasmolin II, Pyrethrin I And Pyrethrin II)*	0.349	25.3	1
Fluroxypyr	0.293	1.1	1
Diflufenzopyr	0.008	0.1	2
Total	29,266.9	33,289	

For the Industrial Vegetation, Noxious Weeds and Invasive Plant Management section, glyphosate was the most used AI, MCPA was the second, and triclopyr was the third. However, glyphosate, aminopyralid and metsulfuron-methyl treated the most area.

Invasive Fish Management

The Invasive Fish Management section of this report refers to a pesticide AI used to treat invasive fish. Invasive fish are fish from a different part of the world that are transported or migrate due to climate change beyond their natural range and become established in a new area where they can cause harm to native ecosystems. This report includes data from one permit for eradication of an invasive fish at Windy Lake where 2,498 kg of Rotenone used. The 2498 kg of the AI of rotenone was used to re-store ecological balance to Windy Lake as invasive fish were out-competing native fish species for food, nutrients and habitat. In future, the public can assist in preventing the need for this treatment by not releasing invasive fish, such as goldfish or koi fish, into natural water bodies.

Mosquito Suppression and Control in B.C.

Review the Following in Section: 3 Understanding the Data



1. Active Ingredient (AI)
2. Area Treated
3. Product vs. Active Ingredient
4. Insects for Pest Control
5. Number of Authorization Holders

In B.C., mosquito management is conducted on both private and public land. It consists primarily of aerial and ground applications of biological pesticides targeting larval stages of these pests. Mosquito habitats are found across B.C. and consist of natural and man-made habitats including: ponds, sloughs, flood plains, tidal marshes, catch-basins, ditches, residential water features and eaves troughs. Mosquito and biting fly control programs are developed to control the nuisance associated with mosquito activity and to reduce the risk of harm to human health and the environment through insect-borne disease transfers.

Historically, pesticides were used to target mosquitos and biting flies in the adult stage of their life-cycle (adulticiding). Today, biological lavicides are used to control the mosquito populations at the larval stage of their life-cycle (larviciding) and work by stopping the growth of mosquitos and biting flies from reaching the adult stage in their life-cycle.

Data for the mosquito suppression and control section is from AUS submissions from confirmation holders and licensees who reported using larvicides or adulticides in 2017. This data does not capture mosquito or biting fly management done by private land owners. In 2017, there were four AIs reported for mosquito control and biting fly management in B.C. (Table 7). *Bacillus thuringiensis* var. *israelensis* (Bti) was the most widely used AI with a total amount of 220,071.7 kg of AI applied. Following, there was 434.5 kg of *Lysinibacillus sphaericus*, 3.1 kg of methoprene, and 1.1 kg of permethrin reported used. Confirmation holders reported treated 11,053.3 ha with Bti, 7.02 ha with *Lysinibacillus sphaericus*, and 0.65 ha with methoprene.

Table 7: Quantity of active ingredient (AI), area treated by each AI and the number of times the AI was reported used for mosquito suppression and control in B.C. in 2017

Pesticide Active Ingredients	Quantity of Active Ingredient Used (kg)	Total Area Treated (ha)	# of Times AI was Reported Used
<i>Bacillus thuringiensis israelensis</i> (Bti)	220,071.7	11,053.5	46
<i>Lysinibacillus sphaericus</i> ⁶	434.5	7.02	8
Methoprene	3.1	0.65	37
Permethrin	1.1	*Not Applicable ⁷	1
Total	220,510.5 kg	10,993.5 ha	

⁶ Reclassified - previously known as *Bacillus sphaericus*

⁷ Permethrin is used as an aerosol spray for adulticiding pest management in aircrafts.

Of the 220,510.5 kg of AI used for mosquito suppression and control, 65,887.7 kg was applied through aerial applications to 5,278.8 ha and 154,622.8 kg was applied through ground applications, which covered an area of 5,782.3 ha (Figure 6). Non-chemical methods for mosquito control covered 33 ha.




Aerial Applications	Ground Applications	Non-Chemical Methods
		
Area Treated: 5,278.8 ha	Area Treated: 5,782.3 ha	Area Treated: 33 ha
Amount of AI Used: 65,887.7 kg	Amount of AI Used: 154,622.8 kg	

Figure 7: Integrated pest management treatment methods used for mosquito control and suppression in B.C. in 2017

Types of ground applications for this section include: backpack- blower, backpack- broadcast, and hand gun applications. Types of non-chemical control for this section include: dredging, draining, filling, and mechanical removal of harborage and resting spots for mosquitos such as grass cutting, brush cutting and mowing. Other techniques for mosquito and biting fly management are done in B.C. but are not included in this report; this includes the installation of bat houses, swallow houses and bird boxes.

When comparing the integrated pest management methods used for mosquito control and suppression, the aerial and ground applications covered relatively similar area. Aerial applications accounted for 48% of the area treated covering 5,278.8 ha while ground applications accounted for 52% of the area treated and covered 503.5 ha more than aerial applications (Figure 8). Non-chemical methods used represent 0.3% of the area treated.

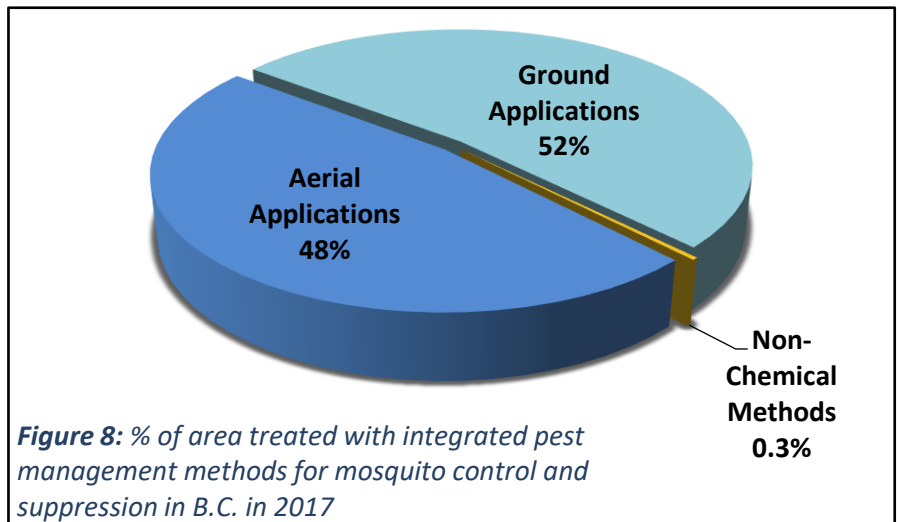


Figure 8: % of area treated with integrated pest management methods for mosquito control and suppression in B.C. in 2017

Pesticide Use for Wood Pole Preservation in B.C

Review the Following in Section: 3 Understanding the Data



1. Active Ingredient (AI)
2. Schedule 2
3. Number of Authorization Holders

In B.C., wood pole preservation is conducted by the utility (electricity and communications) sector to preserve wood poles in order to enhance the resiliency of the wood from rain, ice, snow, insects, decay and fungi. Some AIs reported in this section are listed on Schedule 2 and are excluded from the record-keeping and reporting requirements listed in the IPMR; these items include: disodium octaborate tetrahydrate, borax and boracic acid. However, as they are a significant component of wood preservation activities and there are a few number of companies who voluntarily report their use, they have been included in this report for this sector only. In addition, area treated is not reported for this category as proponents are required to submit number of poles treated and not total area treated⁸.

The AI with the most reported use was disodium octaborate tetrahydrate with a total of 18,854.1 kg reported used (Table 8). Metam-sodium had the second highest use with 1,666.5 kg of AI used, following is Borax with 1,563.1 kg being reported, then boracic acid with 924 kg of reported and copper hydroxide with only 721 kg reported use. The AI that was used the least for wood pole preservation in B.C. in 2017 was copper naphthenate with only 0.5 kg reported used.

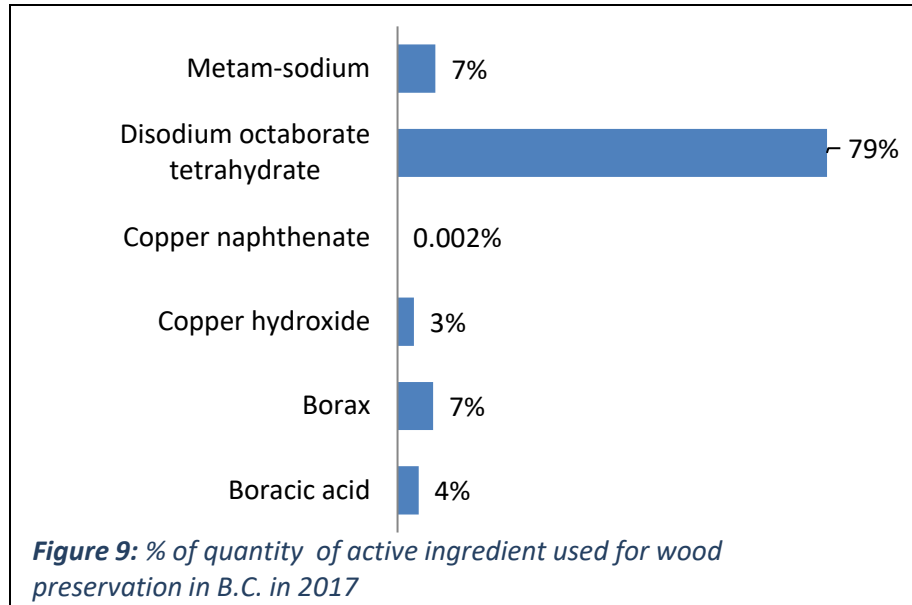
Table 8: *Quantity of active Ingredient (AI) used and the Number of times AI was reported used for wood pole preservation in B.C. in 2017*

Pesticide Active Ingredients	Quantity of Active Ingredient Used (kg)	# of Times AI was Reported Used
Disodium octaborate tetrahydrate	18,854.1	38
Metam-sodium	1,666.5	2
Borax	1,563.1	5
Boracic acid	924	7
Copper hydroxide	721.2	12
Copper naphthenate	0.5	2
Total	23,729.5 kg	

When comparing these values, disodium octaborate tetrahydrate was used significantly more than any other AI. Of the 23,729 kg of AI reported, 79% was disodium octaborate tetrahydrate. Both metam-sodium and borax represent 7% of the amount of AI used and boracic acid and copper hydroxide

⁸ The number of poles treated with pesticide for wood pole preservation in B.C in 2017 was 317,455 poles.

represent 4% and 3%, respectively. The least used AI for wood pole preservation was copper naphthenate representing 0.002% (Figure 9).



Pesticides Use in the Structural Sector

Review the Following in Section: 3 Understanding the Data



1. Active Ingredient (AI)
2. Area Treated
3. Product vs. Active Ingredient
4. Number of Authorization Holders

156 structural licensees reported using pesticides for pest management in 2017. Structural pest control includes management of nuisance and wood-destroying pests (rodents, birds and insects) that may invade structures including residential and commercial properties, ships, docks, and railroad containers.

Data for this section is from 156 authorization holders who use pesticides to manage structural pests and require a license under the IPMR. Area treated is not required to be reported for structural licensees. Of the data received, there were four product types reported: insecticide, fungicide, rodenticide and acaricide (Table 9). Insecticides were the most used product with a total use of 2,164.8 kg. There was 25.4 kg of fungicide used, 5.1 kg of rodenticide used and 0.02 kg of acaricide used in 2017. In total, 2,195.3 kg of AI was used to treat or mitigate structural pests in B.C. in 2017. Of that, 98.6% was insecticide, 1% was rodenticide, 0.2% was fungicide and 0.001% was acaricide.

Table 5: Amount of Pesticide Used by Product by the Structural Sector

Product Type	Quantity of AI Used (kg)
1. Insecticide	2,169
2. Fungicide	25.4
3. Rodenticide Regulator	5.1
4. Acaricide	0.02
Total	2,199.5

Table 10 provides a full list of the AIs used by the structural sector in 2017. Generally, proponents reported applying relatively small amounts for the majority of the AIs used. Permethrin was the most widely used AI with 1,679.2 kg and it's use was reported 173 times. Following that, the second AI with the most reported use was lambda-cyhalothrin with 132.2 kg reported used 76 times in B.C. in 2017.

Table 6: Quantity of active ingredient (AI) and the number of times the AI was reported used in the Structural Sector in B.C. in 2017

Pesticide Active Ingredients ⁹	Quantity of AI (kg)	# of Times AI was Reported Used
Permethrin	1,679.2	173
Lambda-cyhalothrin	132.2	76
Piperonyl butoxide*	110.7	97
Octylbicyclo heptene dicarboximide	67	64
Carbaryl	35.3	4
Cyfluthrin	30.6	50
Malathion	20.9	2
Pyrethrins* other than Cinerin I, Cinerin Ii, Jasmolin I, Jasmolin Ii, Pyrethrin I And Pyrethrin Ii	18.2	69
Chlorantraniliprole	15.8	10
Ferbam	12.2	1
Dichlorvos	10.5	6
Imidacloprid	10.1	82
Copper Hydroxide	9	1
Pyrethrins* (Cinerin I, Cinerin Ii, Jasmolin I, Jasmolin Ii, Pyrethrin I And Pyrethrin Ii)	8	27
Cyantraniliprole	8	1
Hydramethylnon	6.4	52
Bromadiolone	4.8	196
Acephate	4.5	2

⁹ Active Ingredients with a (*) indicate that only commercial class pesticides of those items are represented in this report.

Beta-cyfluthrin	3.9	34
Clothianidin	2.5	38
Thiophanate-methyl	1.9	2
D-trans allethrin*	1.8	4
D-phenothrin*	1.4	21
Acetamiprid	0.952	1
Mancozeb	0.750	1
Deltamethrin	0.500	1
Iprodione	0.500	1
Copper oxychloride	0.500	1
Spinetoram	0.425	1
Myclobutanil	0.400	1
Chlorothalonil	0.173	2
Difethialone	0.139	57
Abamectin	0.074	65
Diphacinone	0.063	14
Brodifacoum	0.049	39
Bendiocarb	0.029	3
Thiamethoxam	0.019	49
Chlorophacinone	0.016	4
Bromethalin	0.014	10
Muscalure	0.010	8
Methomyl	0.004	1
Zinc phosphide	0.004	1
Propiconazole	0.001	1
Fludioxonil	0.0003	1
Total	2,199.5	

As structural pesticides are targeted at pests such as insects, fungus and spiders the amount of AI reported correlates to the small amount of active needed to effectively manage structural pests (a small pellet, bait or dust). It could also be because smaller areas are treated and often with more targeted approach (e.g., crack and crevice sprays). As structural pests are in close proximity to people, risk to human health with pesticide use has to be low. For example, bromadiolone use was reported 196 times but a very low amount of use was reported (4.8 kg), which is attributed to a very low concentration of AI within products.

Pesticide Use in the Fumigation Sector

Review the Following in Section: 3 Understanding the Data



1. Active Ingredient (AI)
2. Product vs. Active Ingredient
3. Number of Authorization Holders

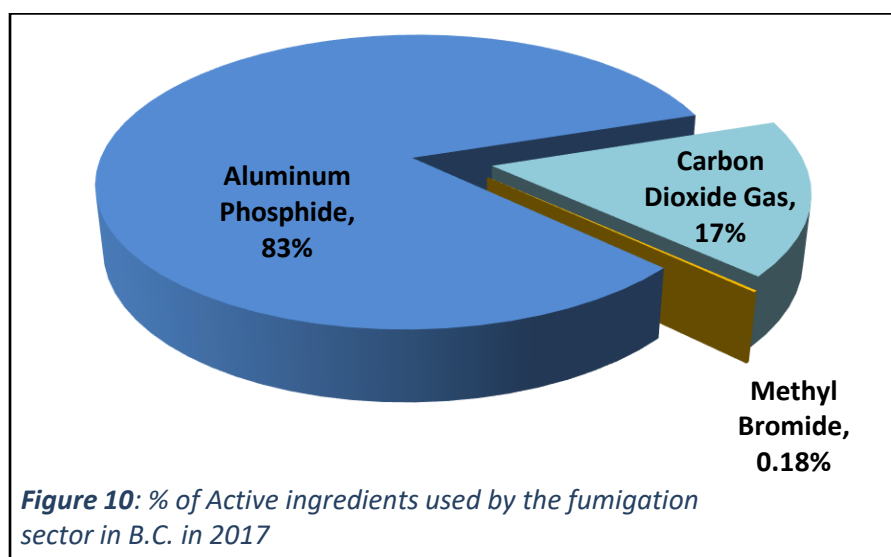
Fumigation is a method of pest control which uses a fumigant (gaseous pesticide) to poison pests. Data for this section was provided from three licensees who reported using AIs for fumigation purposes in 2017. It is not required for area treated to be reported by the fumigation sector.

Three AIs were reported by three authorization holders in the fumigation sector in B.C. in 2017 (Table 11). The most widely used AI was aluminum phosphide with 31,299.6 kg used. The AI with the second highest use was carbon dioxide gas with a total use of 6,342.3 kg and there was 69 kg used of methyl bromide.

Table 71: Quantity of active ingredient used by the fumigation sector in B.C. in 2017

Active Ingredient (AI)	Amount of AI Used
Aluminum phosphide	31,299.6
Carbon dioxide gas	6,342.3
Methyl bromide	69
Total	37,710.8

In total, 37,715 kg of AI was used by the fumigation sector in 2017. Of that, 83% was aluminum phosphide, 17% was carbon dioxide gas, and 0.18% was methyl bromide (Figure 10).



Pesticide Use in the Landscape Sector

Review the Following in Section: 3 Understanding the Data



1. Active Ingredient (AI)
2. Product vs. Active Ingredient
3. Number of Authorization Holders

Pesticides are used in landscaped areas to manage insects, weeds, and diseases on and around ornamental plants and gardens. This section includes data for turf management, golf courses, public land (e.g., parks) and landscaping on residential and commercial properties. However, these results do not include pesticide used to maintain landscaped areas on private residential land conducted by the land owners. Data for this section of the report is from service and non-service license holders working within the landscape sector in B.C. in 2017.

In 2017, there were 9 different types of pesticide products used for landscape management including fungicides, herbicides, insecticides, animal repellents¹⁰, plant growth regulators, bactericides, acaricides, algaecides, and rodenticides (Table 12). The top three types of pesticide with the most reported use were fungicide, herbicide, and insecticide. The product type with the most reported use was fungicide with 29,986.8 kg reported used 1,492 times. There was 20,267 kg of herbicide used reported 1,046 times and there was 5,606.4 kg of insecticide used, which was reported 210 times. Animal repellents and plant growth regulators had relatively similar amounts of AI used: there was 58.7 kg of animal repellent reported used by a single licensee while there was 49.8 kg of plant growth regulator used by 47 different license holders. The products with the lowest use by the landscape sector in 2017 were crop bactericide (18 kg), acaricide (3.8 kg), algaecide (0.4 kg), and rodenticide (0.001 kg).

Table 8: Amount of pesticide product type used and Number of times the product type was reported used in B.C. in 2017

Pesticide Product Type	Amount of AI (kg)	# of Times AI was Reported Used
Fungicide	29,986.8	1,492
Herbicide	20,267	1,046
Insecticide	5,606.4	210
Animal Repellent	58.7	1
Plant Growth Regulator	49.8	47
Crop Bactericide	18	1
Acaricide	3.8	8
Algaecide	0.4	1

¹⁰ Domestic and commercial class animal repellent pesticides are Excluded items listed on Schedule 2. This report only refers to Thiram, which is an exception to the Schedule 2 reference.

Rodenticide	0.001	3
Total	55,990.7	

In total, 55,990.7 kg of AI was used by the landscape sector in 2017. Of that, 54% was fungicide, 36% was herbicide, 10% was insecticide, and less than 1% was represented by plant growth regulators, crop bactericide, acaricide, algaecide, rodenticide, and animal repellent.

Table 13 represents only a portion of the Landscape data. It outlines each AI reported, the amount of AI used, and it outlines how many times that AI was reported. For a complete list of the AI's reported by the landscape sector review Appendix B.

Table 93: *Quantity of active ingredient (AI) and the number of times the AI was reported used in the Landscape Sector in B.C. in 2017*

Active Ingredient ¹¹	Amount of AI Used (kg)	# of Times AI was Reported Used
Mineral oil*	15,265.1	66
Chlorothalonil	12,759.8	275
Glyphosate	8,285.7	249
2,4-D	6,145.4	202
Mecoprop-p-dimethylammonium	2,788.5	176
Iprodione	2,568.3	211
Propiconazole	1,081.3	215
Fosetyl-al	959.7	30
Dichlobenil	731.1	44
Dicamba	636.3	194
Diuron	636	3
Thiophanate-methyl	499.2	17
Fludioxonil	337.1	192
Picloram	333.9	11
Carbaryl	306	26
Sulphur*	240.9	6
Trifloxystrobin	224.3	151
Copper hydroxide	212.3	12
Acetic acid*	193.2	21
Permethrin	173.9	17
Triticonazole	167.3	89
Lime Sulphur*	109.3	15

¹¹ Active Ingredients with a (*) indicate that only commercial class pesticides of those items are represented in this report.

Pesticide Use in the Aquaculture Sector

Pesticides are used by the aquaculture sector in B.C. to control sea lice infestations. An infestation of sea lice can affect the survivability of very young salmon and, in severe cases, older stock. Sea lice occur naturally in the environment, and conditions in aquaculture facilities may exacerbate infestations due to increased fish density and continual host presence. Therefore, sea lice are managed with both chemical bath treatments and non-chemical methods. Chemotherapeutants refers collectively to veterinary drugs and pesticides used to treat sea lice. Good aquacultural stewardship of the marine environment in B.C. supports environmentally protective values. Robust husbandry practices, diligent monitoring and targeted intervention, including the judicious use of chemotherapeutants, should pose a low risk for adverse impacts to the environment.

The use of pesticides in a body of water requires a pesticide use permit issued under the IPMA. Data for this section is from six permits that were issued for hydrogen peroxide bath treatments using tarp and well boat applications. Current treatment options have been limited to using temporary enclosures in net pens with tarps or using well boats that have a compartment for this purpose. Veterinary drugs are not regulated under the IPMR and their use does not require a permit; thus, their use is not included in this report

While there were 8 permits issued for aquaculture use in 2017, only 6 permit holders used any pesticides. Table 14 outlines the amount of hydrogen peroxide used for each type of application (well boat and tarp).

Table 10: Amount of Hydrogen Peroxide Use by Tarp and Well Boat Applications by the Aquaculture Sector in B.C. in 2017

Type of Application Method	Amount of Hydrogen Peroxide used (kg)	# of Times AI was Reported Used
Tarp Application	121,329	2
Well Boat Application	226,989	6
Total	348,318	

There was 121,329 kg of hydrogen peroxide used with the tarp application method and 226,989 kg used with a well boat application method. In total, there was 348,318 kg of hydrogen peroxide used by the aquaculture sector.

Section 5: Conclusion

In B.C., the IPMA requires the use of IPM when considering pesticide use to manage pests. In addition, pesticide use is managed through a certification and authorization system monitored by the ENV. IPM is intended to improve the success of pest management efforts while reducing their impact on the environment and reducing risks to human health. The use of pesticides in combination with other efforts may be necessary to suppress pests that threaten natural biodiversity, human health, and/or the environment.

Data from this report were from mandatory AUS's submitted to ENV each year. These data may have been influenced by proponent bias through proponent-recording, summarizing, and estimating and by ENV staff through data control and analysis. There are pesticide applications done in B.C. that do not require an authorization and therefore are not required to provide annual data to ENV. Hence, this report does not include pesticide application information from every pesticide application done in B.C. in 2017. In addition, there is a wide range of factors that affect pesticide applications and use each year. These include aspects such as: environmental factors, climate change, invasive species movement, biological life cycles, natural resource disasters/ threats, budgets and competing interests. Overall, there is a wide variation in pesticide use year to year.

Works Cited

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Pest Control Products Act, 2002, c.28.

Appendices

Appendix A: Schedule 2 as Outlined in the IPMR

Excluded Pesticides

- 1 acetic acid (DOMESTIC)
- 2 animal repellents (DOMESTIC and COMMERCIAL) except thiram
- 3 anti-fouling paints (DOMESTIC and COMMERCIAL)
- 4 antisapstain wood preservatives used on private, industrial land owned by the company or person responsible for applying the preservatives (COMMERCIAL)
- 5 asphalt solids used as pruning paints (DOMESTIC and COMMERCIAL)
- 6 bactericides used in petroleum products (DOMESTIC and COMMERCIAL)
- 7 boron compounds (DOMESTIC)
- 8 boron compounds formulated with up to 5% copper for insect control and wood preservation (DOMESTIC and COMMERCIAL)
- 9 capsaicin (DOMESTIC, COMMERCIAL and RESTRICTED)
- 10 cleansers (DOMESTIC and COMMERCIAL)
- 11 corn cellulose (DOMESTIC and COMMERCIAL)
- 12 corn gluten (DOMESTIC and COMMERCIAL)
- 13 deodorizers (DOMESTIC and COMMERCIAL)
- 14 d-phenothrin (DOMESTIC)
- 15 d-trans-allethrin, also referred to as d-cis, trans allethrin (DOMESTIC)
- 16 fatty acids (DOMESTIC and COMMERCIAL)
- 17 ferric phosphate (DOMESTIC and COMMERCIAL)
- 18 ferrous sulphate (DOMESTIC and COMMERCIAL)
- 19 formic acid (DOMESTIC and COMMERCIAL)
- 20 hard surface disinfectants (DOMESTIC and COMMERCIAL)

- 21 insect repellents (DOMESTIC)
- 22 insect semiochemicals, including pheromones, kairomones, attractants and repellents (DOMESTIC and COMMERCIAL)
- 23 insecticides sold and used in tamper-resistant bait stations (DOMESTIC)
- 24 kaolin (DOMESTIC and COMMERCIAL)
- 25 laundry additives (DOMESTIC and COMMERCIAL)
- 26 material preservatives (DOMESTIC and COMMERCIAL)
- 27 methoprene (DOMESTIC)
- 28 mineral oils for insect and mite control (DOMESTIC)
- 29 naphthalene for fabric protection (DOMESTIC)
- 30 n-octyl bicycloheptene dicarboximide (DOMESTIC)
- 31 octenol (DOMESTIC and COMMERCIAL)
- 32 oxalic acid (DOMESTIC and COMMERCIAL)
- 33 paradichlorobenzene for fabric protection (DOMESTIC)
- 34 pesticides in aerosol containers (DOMESTIC)
- 35 pesticides registered under the federal Act for application to pets (DOMESTIC and COMMERCIAL)
- 36 piperonyl butoxide (DOMESTIC)
- 37 plant growth regulators (DOMESTIC)
- 38 polybutene bird repellents (DOMESTIC and COMMERCIAL)
- 39 pyrethrins (DOMESTIC)
- 40 resmethrin (DOMESTIC)
- 41 silica aerogel, also referred to as silica gel, amorphous silica and amorphous silica gel (DOMESTIC and COMMERCIAL)
- 42 silicon dioxide, also referred to as diatomaceous earth (DOMESTIC and COMMERCIAL)

- 43 slimicides (COMMERCIAL)
- 44 soaps (DOMESTIC and COMMERCIAL)
- 45 sulphur, including lime sulphur, sulphide sulphur and calcium polysulphide (DOMESTIC)
- 46 surfactants (DOMESTIC and COMMERCIAL)
- 47 swimming pool algicides and bactericides (DOMESTIC and COMMERCIAL)
- 48 tetramethrin (DOMESTIC)
- 49 thymol (DOMESTIC and COMMERCIAL)
- 50 wood preservatives (DOMESTIC)
- 51 zinc strips (DOMESTIC)

Appendix B: Amount of Active Ingredient Used and Area Treated per Active Ingredient and Number of Times AI Was Reported Used by the Landscape Sector in 2017

Pesticide Active Ingredient ¹²	Amount of AI Used (kg)	# of Times AI Was Reported Used
Mineral oil*	15,265.1	66
Chlorothalonil	12,759.8	275
Glyphosate	8,285.7	249
2,4-D	6,145.4	202
Mecoprop-p-dimethylammonium	2,788.5	176
Iprodione	2,568.3	211
Propiconazole	1,081.3	215
Fosetyl-al	959.7	30
Dichlobenil	731.1	44
Dicamba	636.3	194
Diuron	636	3
Thiophanate-methyl	499.2	17
Fludioxonil	337.1	192
Picloram	333.9	11
Carbaryl	306	26
Sulphur*	240.9	6
Trifloxystrobin	224.3	151
Copper hydroxide	212.3	12
Acetic acid*	193.2	21
Permethrin	173.9	17
Triticonazole	167.3	89
Lime Sulphur*	109.3	15
Mecoprop	95.2	5
Simazine (Plus Related Active Triazines)	78.8	3
Spinosad	76.6	18
Copper oxychloride	71.8	13
Thiram	58.7	1
Azoxystrobin	58	63
Acephate	56.4	8
MCPA	54.7	8
Tebuconazole	52.9	22
Mono- and dipotassium phosphite	51.7	3

¹² Active Ingredients with a (*) indicate that only commercial class pesticides of those items are represented in this report.

Trinexapac-ethyl	49.5	41
Fluoxastrobin	49.1	25
Aminopyralid	46	14
Captan	33.5	6
Mecoprop-p-potassium	33.2	7
Mecoprop-p	27.4	5
Imazapyr	27.2	5
Triclopyr	26.7	7
Amitrole	25.7	11
Diquat	25.6	6
Imidacloprid	25.4	35
Pyraclostrobin	24.2	16
Spinetoram	22	10
<i>Pseudomonas fluorescens</i>	18	1
Dichlorprop-p-2-ethylhexyl	16.8	1
Malathion	13.3	3
Metconazole	12.6	9
Penthiopyrad	11.3	11
Benzovindiflupyr	10.8	4
Ferbam	10.6	4
Chlorantraniliprole	10.2	15
Boscalid	9.9	3
Myclobutanil	9.8	16
FeHEDTA	9.6	7
Hydrogen peroxide	9.2	2
Carfentrazone-ethyl	9.2	40
<i>Bacillus thuringiensis israelensis</i>	8.9	2
Propamocarb hydrochloride	8.3	2
Tribenuron-methyl	7.7	1
Pottassium bicarbonate	7.4	4
<i>Bacillus subtilis</i>	6	3
<i>Bacillus thuringiensis var. berliner ssp kurstaki</i>	5.7	6
Indaziflam	5.5	2
Fenoxaprop-ethyl	5.4	1
Metsulfuron-methyl	5.2	7
Fluopyram	4.8	8
Acetamiprid	4.8	8
Metalaxyl-m and s-isomer	4.7	12
Aminocyclopyrachlor	4.5	1
Chlorsulfuron	4.4	2
Mandestrobin	4.3	1
Fenbutatin oxide	3.5	2

Copper Sulphate	2.7	1
Clopyralid	2.6	7
Imazethapyr	2.4	1
Pyrethrins*	2.3	3
Thiacloprid	1.6	2
cyantraniliprole	1.5	4
Flumioxazin	1.3	2
<i>Beauveria bassiana strain gha</i>	1.3	1
Pyroxasulfone	1.2	1
Methoxyfenozide	1.1	2
Cyazofamid	1	1
Triforine	0.92	3
Zineb	0.71	1
Diflufenzopyr	0.68	1
Copper sulphate pentahydrate	0.38	4
Pyridaben	0.32	2
Bifenazate	0.26	5
Daminozide	0.20	3
Sethoxydim	0.16	1
Novaluron	0.15	1
<i>Streptomyces griseoviridis strain K61</i>	0.10	1
Extract of <i>Reynoutria sachalinensis</i>	0.07	1
Spiromesifen	0.07	3
<i>Trichoderma harzianum rifai strain T22</i>	0.05	1
Etridiazole	0.05	2
Chlormequat Chloride	0.05	2
Kinoprene	0.04	2
Flonicamid	0.04	1
Octylbicyclo heptene dicarboximide	0.02	1
Quinoxifen	0.01	1
Fenhexamid	0.01	1
Pymetrozine	0.01	1
Pyriproxyfen	0.01	1
Acequinocyl	0.005	1
Abamectin	0.005	5
Diflubenzuron	0.003	1
Spirotetramat	0.002	1
Brodifacoum	0.001	2
Paclobutrazol	0.0001	1
Chlorophacinone	0.0001	1

Oxine benzoate	0.0001	1
Total	55,990.7	

Appendix C: A list of Active Ingredients (AI) That Shows the AI by the Number of Authorization Holders That Reported Use

AI Reported	Number of Authorization Holders who reported use per AI
Glyphosate	402
Chlorothalonil	277
2,4-D	245
Dicamba	226
Propiconazole	216
Iprodione	212
Bromadiolone	196
Fludioxonil	193
Permethrin	191
Mecoprop-p-dimethylammonium	183
Trifloxystrobin	151
Imidacloprid	117
Piperonyl Butoxide	98
Triticonazole	89
Aminopyralid	80
Lambda-cyhalothrin	76
Pyrethrins	73
Abamectin	70
Mineral Oil	66
Octylbicyclo Heptene Dicarboximide	65
Azoxystrobin	63
Picloram	57
Difethialone	57
Hydramethylnon	52
Cyfluthrin	50
Metsulfuron-methyl	50
Thiamethoxam	49
<i>Bacillus Thuringiensis Israelensis</i>	48
Dichlobenil	45
Triclopyr	44
Brodifacoum	41
Trinexapac-ethyl	41
Carfentrazone-ethyl	40
Disodium Octaborate Tetrahydrate	38
Clothianidin	38

Methoprene	37
Beta-cyfluthrin	34
Mcpa	31
Carbaryl	30
Fosetyl-al	30
Cinerin I, Cinerin li, Jasmolin I, Jasmolin li, Pyrethrin I And Pyrethrin li	28
Clopyralid	26
Chlorantraniliprole	25
Copper Hydroxide	25
Fluoxastrobin	25
Imazapyr	24
Acetic Acid	23
Tebuconazole	22
D-phenothrin	21
Thiophanate-methyl	19
Spinosad	18
Myclobutanil	17
Pyraclostrobin	16
Lime Sulphur	15
Copper Oxychloride	14
Diphacinone	14
Metalaxyl-m And S-isomer	12
Amitrole	12
Penthiopyrad	11
Spinetoram	11
Bromethalin	10
Acephate	10
FeHedta	9
Metconazole	9
Acetamiprid	9
Fluopyram	8
Muscalure	8
<i>Bacillus Sphaericus</i>	8
Diquat	7
<i>Bacillus Thuringiensis Berliner Ssp Kurstaki</i>	7
Boracic Acid	7
Indaziflam	7
Mecoprop-p-potassium	7
Dichlorvos	6
Sulphur*	6
Captan	6

Diuron	6
Mecoprop	5
Malathion	5
Flumioxazin	5
Ferbam	5
Bromoxynil	5
Bifenazate	5
Chlorophacinone	5
Borax	5
cyantraniliprole	5
Mecoprop-p	5
Simazine Plus Related Active Triazines	4
Chlorsulfuron	4
3-Iodo-2-propynyl butyl carbamate	4
Benzovindiflupyr	4
Copper Sulphate Pentahydrate	4
Pottassium Bicarbonate	4
D-trans Allethrin	4
<i>Bacillus Subtilis</i>	3
Bendiocarb	3
Mono- And Dipotassium Phosphite	3
Boscalid	3
Spiromesifen	3
Aluminum Phosphide	3
Diflufenzopyr	3
Aminocyclopyrachlor	3
Triforine	3
Daminozide	3
Octadec-9-onoic Acid, Methyl Ester	3
Hydrogen Peroxide	3
Pyridaben	2
Etridiazole	2
Kinoprene	2
Propamocarb Hydrochloride	2
Alcohol ethoxylate	2
Fenbutatin Oxide	2
Copper Naphthenate	2
Methoxyfenozone	2
Methyl Ester	2
Thiacloprid	2
Chlormequat Chloride	2
Metam-sodium	2
Flonicamid	1

Mancozeb	1
Deltamethrin	1
Carbon Dioxide Gas	1
Thiram	1
Mesosulfuron-methyl	1
Zinc Phosphide	1
Diflubenzuron	1
<i>Streptomyces Griseoviridis Strain K61</i>	1
Cyazofamid	1
Fenoxaprop-ethyl	1
Copper Sulphate	1
<i>Trichoderma Harzianum Rifai strain T22</i>	1
<i>Pseudomonas Fluorescens</i>	1
Paclobutrazol	1
Pymetrozine	1
ZINEB	1
Acequinocyl	1
Spirotetramat	1
Methomyl	1
Fenhexamid	1
Extract of <i>Reynoutria sachalinensis</i>	1
Mandestrobin	1
Pyriproxyfen	1
Novaluron	1
Pyroxasulfone	1
Tribenuron-methyl	1
Quinoxifen	1
Dichlorprop-p-2-ethylhexyl	1
Rotenone	1
Oxine Benzoate	1
Sethoxydim	1
Imazethapyr	1
Fluroxypyr	1
<i>Beauveria Bassiana Strain Gha</i>	1
Methyl Bromide	1
Glufosinate Ammonium	1

Appendix D: A List of Active Ingredients (AI) That Shows the AI by the Most AI Applied to Least AI Applied

Active Ingredient (AI)	Amount of Active Ingredient Used in 2017(kg)
Hydrogen Peroxide	348327
<i>Bacillus Thuringiensis Israelensis</i>	220081
Glyphosate	54474
Aluminum Phosphide	31300
Disodium Octaborate Tetrahydrate	18854
Mineral Oil	15265
Chlorothalonil	12760
2,4-D	8386
Carbon Dioxide Gas	6342
Triclopyr	4718
Mcpa	2898
Mecoprop-p-dimethylammonium	2794
Iprodione	2569
Rotenone	2498
<i>Bacillus Thuringiensis Berliner Ssp Kurstaki</i>	2155
Permethrin	1854
Metam-sodium	1667
Dicamba	1613
Borax	1563
Picloram	1248
Propiconazole	1081
Diuron	982
Fosetyl-al	960
Copper Hydroxide	943
Boracic Acid	924
Aminopyralid	789
Dichlobenil	736
Thiophanate-methyl	501
<i>Bacillus Sphaericus</i>	435
Carbaryl	341
Fludioxonil	337
Sulphur	241
Trifloxystrobin	224
Acetic Acid	203
3-Iodo-2-propynyl butyl carbamate	177
Triticonazole	167
Imazapyr	162

Indaziflam	147
Lambda-cyhalothrin	132
Metsulfuron-methyl	121
Piperonyl Butoxide	113
Lime Sulphur	109
Simazine Plus Related Active Triazines	100
Mecoprop	95
Spinosad	77
Copper Oxychloride	72
Methyl Bromide	69
Octylbicyclo Heptene Dicarboximide	67
Acephate	61
Thiram	59
Azoxystrobin	58
Clopyralid	56
Tebuconazole	53
Mono- And Dipotassium Phosphite	52
Trinexapac-ethyl	50
Fluoxastrobin	49
Diquat	36
Imidacloprid	36
Methyl Ester	34
Malathion	34
Captan	34
Mecoprop-p-potassium	33
Cyfluthrin	31
Amitrole	31
Mecoprop-p	27
Octadec-9-onoic Acid, Methyl Ester	27
Chlorantraniliprole	26
Pyraclostrobin	24
Alcohol ethoxylate	24
Ferbam	23
Spinetoram	22
Pyrethrins	20
Flumioxazin	19
<i>Pseudomonas Fluorescens</i>	18
Dichlorprop-p-2-ethylhexyl	17
Metconazole	13
Chlorsulfuron	12
Aminocyclopyrachlor	11
Penthiopyrad	11
Benzovindiflupyr	11

Dichlorvos	11
Myclobutanil	10
FeHedta	10
Boscalid	10
cyantraniliprole	10
Carfentrazone-ethyl	9
Cinerin I, Cinerin li, Jasmolin I, Jasmolin li, Pyrethrin I And Pyrethrin li	8
Propamocarb Hydrochloride	8
Tribenuron-methyl	8
Pottassium Bicarbonate	7
Hydramethylnon	6
<i>Bacillus Subtilis</i>	6
Acetamiprid	6
FENOXAPROP-ETHYL	5
Bromadiolone	5
Fluopyram	5
Metalaxyl-m And S-isomer	5
Mandestrobin	4
Beta-cyfluthrin	4
Bromoxynil	4
Fenbutatin Oxide	4
Methoprene	3
Copper Sulphate	3
Clothianidin	3
Imazethapyr	2
Glufosinate Ammonium	2
D-trans Allethrin	2
Thiacloprid	2
D-phenothrin	1
<i>Beauveria Bassiana Strain Gha</i>	1
Pyroxasulfone	1
Methoxyfenozide	1
Mesosulfuron-methyl	1
Cyazofamid	1
Triforine	0.92
Mancozeb	0.75
ZINEB	0.71
Diflufenzopyr	0.69
Deltamethrin	0.50
Copper Naphthenate	0.49
Copper Sulphate Pentahydrate	0.38
Pyridaben	0.32

Fluroxypyr	0.29
Bifenazate	0.26
Daminozide	0.20
Sethoxydim	0.16
Novaluron	0.15
Difethialone	0.14
<i>Streptomyces Griseoviridis Strain K61</i>	0.10
Abamectin	0.08
Extract of <i>Reynoutria sachalinensis</i>	0.07
Spiromesifen	0.07
Diphacinone	0.06
<i>Trichoderma Harzianum Rifai strain T22</i>	0.05
Brodifacoum	0.05
Etridiazole	0.05
Chlormequat Chloride	0.05
Kinoprene	0.04
Flonicamid	0.04
Bendiocarb	0.03
Thiamethoxam	0.02
Chlorophacinone	0.02
Bromethalin	0.01
Quinoxifen	0.01
Fenhexamid	0.01
Pymetrozine	0.01
Muscalure	0.01
Pyriproxyfen	0.01
Acequinocyl	<0.00
Methomyl	<0.00
Zinc Phosphide	<0.00
Diflubenzuron	<0.00
Spirotetramat	<0.00
Paclobutrazol	<0.00
Oxine Benzoate	<0.00